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Marketing Research Report No. 887

**CANDIDATE MOTHPROOFERS:  
Toxicity to Fabric Insects  
and Persistence Through  
Washing and Drycleaning**

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## PREFACE

This publication reports the results of a series of tests of various compounds that were thought to have promise as potential mothproofers. Research along this line is continuing. The study is part of a broad program of research on methods of protecting fabrics and materials from insect damage in storage. Those compounds that continue to show promise through these screening tests will be tested further.

Trade names are used in this publication solely for the purpose of providing specific identification of the compounds tested. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement over other products not mentioned.

The chemical names in this report are according to the *Chemical Abstracts* system of nomenclature. They were verified and indexed by Mrs. E. M. Osborne of the Pesticide Chemicals Research Branch, Entomology Research Division, Agricultural Research Service.

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This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.



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# Candidate Mothproofers: Toxicity to Fabric Insects and Persistence Through Washing and Drycleaning Part I

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## SUMMARY

One hundred and thirty-four compounds were investigated as potential mothproofers in 28-day mothproofing tests developed by the American Society for Testing Materials (ASTM). The compounds were applied to the cloth at 0.5 and 3 percent by weight. The test insects were larvae of the black carpet beetle, *Attagenus megatoma* (Fabricius). Results were evaluated according to visible damage and excrement weight. Cloths treated with 22 compounds passed all requirements of the test method for

satisfactory protection before cleansing. Seven of these compounds applied at 3 percent by weight satisfactorily protected the cloth after one washing, two after one drycleaning, and three after one washing and one drycleaning. Dicapthon (ENT-17035) was the only compound that protected the cloth on the basis of all test criteria at both treatment levels. Only DDT, Perthane®, and Strobane® obtained their effectiveness by action other than toxicity.

## INTRODUCTION

Estimates of losses in the United States from insects that feed on fabrics range from \$100 million to as much as \$1 billion annually. Inexpensive and safe mothproofers to protect against such damage are urgently needed. In support of this need, the USDA Agricultural Research Service conducts a continuing program at Savannah, Ga., to determine the effectiveness of

candidate compounds in protecting wool, mohair, animal hair, and feathers against fabric-insect damage. The persistence of the effectiveness of these compounds through washings and drycleanings is also determined. The compounds with low mammalian toxicity that were found most promising in these preliminary tests are selected for further investigation as mothproofers when applied under conditions simulating practical home and industrial treatments.

<sup>1</sup> Agricultural research technician and research entomologists, respectively.

## PROCEDURE

Botany-style No. 315 woolen broadcloth (100-percent wool), considered the standard test fabric by the American Association of Textile Chemists and Colorists, was used exclusively as the test fabric. Samples of cloth measuring 3 by 4 inches were impregnated with the test compounds at calculated deposit levels of 0.5 and 3 percent by weight of the cloth. The compounds were formulated as either methyl alcohol or acetone solutions. After treatment, the cloths were thoroughly aired for 3 days to remove volatile constituents. The treated cloths were then cut into 1- by 2-inch pieces and subjected to biological evaluation.

The biological mothproofing evaluations were conducted in accordance with the ASTM D 582-54<sup>2</sup> test method. Each treated cloth was individually exposed in a petri dish to 10 larvae of the black carpet beetle, *Attagenus megatoma* (Fabricius), for the prescribed 28-day test period. In such an exposure, the insects had the choice of staying on or off the treated cloth. The test insects were 3 to 5 months old and weighed 4.5 to 6.5 milligrams (mg.) each. One series of samples (four 1- by 2-inch pieces of cloth) was used from each deposit level. The petri dishes with the insects and test cloths were kept in a darkened cabinet in a room held at a constant temperature of  $80 \pm 2^\circ$  F. and  $60 \pm 5$  percent relative humidity.

If the treated cloths showed resistance to insect feeding in these initial tests, they were also evaluated by the D 582-54 ASTM test after one washing or one drycleaning to determine the resistance of the treatments to cleansing. All cleansings were done in a Launder-Ometer, the standard laboratory machine speci-

fied by the American Association of Textile Chemists and Colorists for washing and drycleaning tests. The test samples were washed for 30 minutes at  $100^\circ$  F. in a solution of 5 grams of neutral chip soap per liter of water, using a water-to-fabric ratio of 30:1 (wt./wt.). After being washed, the materials were squeezed by hand and then rinsed for 10 minutes at  $80^\circ$  F. with the same water-to-fabric ratio as in the washing. The drycleaning process consisted of placing two pieces of the treated fabric, 1 by 2 inches, in 50 milliliters of Stoddard solvent and agitating them for 20 minutes at  $90^\circ$  F. The excess solvent was squeezed out by hand and the cloth laid on a horizontal screen to dry at room temperature. When dry, the fabric was pressed with a steam iron and allowed to stand for another day before being tested.

The results were evaluated according to visible damage and excrement weight. The visible damage was expressed as the amount of nap (pile) and warp feeding (holes in or through cloth).

Each sample of treated cloth was considered to be satisfactorily resistant to carpet beetle feeding if (1) no holes or breaking or shearing of fibers was seen; (2) not more than 6 mg. of excrement was deposited by the 10 larvae on a particular sample, provided that under the same conditions, not less than 25 mg. of excrement was deposited by the 10 larvae on an untreated control sample; and (3) the treated cloth showed at least 75-percent protection calculated by the following formula:

$$\text{Percent protection} = 100 - \frac{100 \times \text{weight of excrement on treated specimen in milligrams}}{\text{Weight of excrement on untreated specimen in milligrams}}$$

<sup>2</sup> American Society for Testing Materials Committee D-13 on Textile Materials. Standard methods of test for resistance of textile fabrics and yarns to insect pests. ASTM Designation: D 582-54. ASTM Standards on Textile Materials (With Related Information), pp. 119-124. 1956.

## RESULTS

The results of treating cloth for protection against black carpet beetle larval feeding with the 134 compounds identified in the appendix

on pages 5 through 8 are summarized in tables 1, 2, and 3. Twenty-two of the 134 compounds at one or both of the calculated deposit levels



(0.5 and 3 percent by weight of the cloth) satisfactorily protected the treated cloths before cleansing in accordance with all criteria established for the D 582-54 ASTM 28-day

mothproofing test (table 1). Seven of the 22 compounds at the higher calculated deposit level also satisfactorily protected the cloth after one washing, two after one drycleaning, and

TABLE 1.—*Effectiveness of 22 candidate mothproofing compounds in protecting woolen cloths from black carpet beetle larvae in standard ASTM tests*<sup>1</sup>

Item No. and ENT No. of candidate compound <sup>2</sup>	Calculated deposit by weight of cloth	Resistance of test cloths to larval feeding <sup>3</sup>			Larval mortality		
		Before cleansing 1	After 1 wash- ing	After 1 dry- cleaning	Before cleansing	After 1 wash- ing	After 1 dry- cleaning
	Pct.				Pct.	Pct.	Pct.
Item 9, ENT-23283.....	0.5	U	U	U	2.5	0	30
	3.0	S	U	U	100	0	0
Item 32, ENT-24717.....	.5	S	U	U	100	0	57.5
	3.0	S	U	U	100	0	100
Item 33, ENT-24654.....	.5	S	U	U	97.5	0	45
	3.0	S	U	S	100	0	100
Item 34, ENT-24990.....	.5	U	U	U	0	0	0
	3.0	S	U	U	97.5	0	42.5
Item 39, ENT-17082.....	.5	S	U	U	5	0	0
	3.0	S	S	U	0	0	0
Item 40, ENT-1506.....	.5	S	U	U	0	0	0
	3.0	S	S	S	0	0	0
Item 50, ENT-25700-X.....	.5	U	U	U	100	37.5	0
	3.0	S	U	U	100	97.5	37.5
Item 67, ENT-25713.....	.5	S	U	U	100	25	15
	3.0	S	S	U	100	97.5	90
Item 68, ENT-25755.....	.5	S	U	U	100	60	95
	3.0	S	S	S	100	100	100
Item 69, ENT-25712.....	.5	S	U	U	100	75	35
	3.0	S	S	U	100	100	97.5
Item 71, ENT-23285.....	.5	S	U	U	97.5	0	0
	3.0	S	U	U	100	82.5	0
Item 75, ENT-20738.....	.5	U	U	U	65	0	0
	3.0	S	U	U	95	0	0
Item 76, ENT-25631.....	.5	U	U	U	0	0	0
	3.0	S	U	U	100	0	0
Item 81, ENT-23446.....	.5	S	U	U	97.5	47.5	25
	3.0	S	S	U	100	100	97.5
Item 82, ENT-23437.....	.5	U	U	U	67.5	0	0
	3.0	S	S	U	100	75	0
Item 83, ENT-25506.....	.5	S	U	U	100	2.5	75
	3.0	S	U	U	100	12.5	100
Item 84, ENT-24650.....	.5	S	U	S	100	0	100
	3.0	S	U	S	100	10	100
Item 85, ENT-25737.....	.5	S	U	U	100	0	72.5
	3.0	S	U	U	100	60	90
Item 86, ENT-22734.....	.5	U	U	U	27.5	0	0
	3.0	S	U	U	100	0	0
Item 87, ENT-17035.....	.5	S	S	S	95	100	100
	3.0	S	S	S	97.5	100	100
Item 92, ENT-23284.....	.5	U	U	U	92.5	80	0
	3.0	S	S	U	100	100	0
Item 121, ENT-19442-X.....	.5	S	U	U	2.5	0	0
	3.0	S	S	U	0	0	0

<sup>1</sup> American Society for Testing Materials' 28-day mothproofing test (ASTM D 582-54) provided the test procedure.

<sup>2</sup> Chemical names of the test compounds are listed by item and entomology (ENT) Nos. in the appendix, pp. 5 through 8.

<sup>3</sup> S = Satisfactorily resistant to carpet beetle larval feeding according to all ASTM D 582-54 test criteria; U = unsatisfactorily resistant.

three after one washing and one drycleaning. Dicapthon (item 87 in the appendix list) was the only compound which protected the cloth on the basis of all criteria at both calculated deposit levels. Only Perthane® (item 39), DDT (item 40), and Strobane® (item 121) obtained their effectiveness by action other than toxicity.

Seven compounds at one or both calculated deposit levels protected the cloths before cleansing according to all criteria established for D 582-54 ASTM, except for the larval feeding requirement specified for untreated control samples (footnote 3 to table 2). Cloths treated with dieldrin (item 36) met the criteria for all tests except after one drycleaning at the 0.5-percent level. Cloths treated with allethrin (item 35) at 3 percent by weight met all criteria after one washing.

TABLE 2.—*Mortality among black carpet beetle larvae exposed to cloths treated with 7 candidate mothproofing compounds in standard ASTM tests*<sup>1</sup>

Item No. and ENT No. of candidate compound <sup>2</sup>	Calculated deposit by weight of cloth	Larval mortality			
		Before cleans-1 ing <sup>3</sup>	After 1 wash-ing	After 1 dry-cleaning	
	Pct.	Pct.	Pct.	Pct.	
Item 35, ENT-17510.....	0.5 37.5	0	0		
	3.0 20	0	17		
Item 36, ENT-16225 .....	.5 100	25	0		
	3.0 100	25	18		
Item 51, ENT-25603 .....	.5 0	0	0		
	3.0 10	0	0		
Item 52, ENT-25584.....	.5 85	65	0		
	3.0 82.5	100	72.5		
Item 53, ENT-9932 .....	.5 88	0	0		
	3.0 98	0	0		
Item 89, ENT-19507.....	.5 100	0	43		
	3.0 100	23	98		
Item 114, ENT-17034 .....	.5 100	0	43		
	3.0 100	95	100		

<sup>1</sup> American Society for Testing Materials' 28-day mothproofing test (ASTM D 582-54) provided the test procedure.

<sup>2</sup> The chemical names of the test compounds are listed by item and entomology (ENT) Nos. in the appendix, pp. 5 through 8.

<sup>3</sup> Satisfactorily protected cloths before cleansing in accordance with all ASTM D 582-54 test criteria except one: larval excrement on untreated controls measured less than the 2.5 mg. per larva specified.

Twenty compounds at one or both rates of application protected the cloths before cleansing according to all criteria established for the ASTM D 582-54 28-day mothproofing test ex-

cept that visible damage was present (footnote 3 to table 3).

The remaining 85 compounds failed to meet any of the ASTM test criteria.

TABLE 3.—*Mortality among black carpet beetle larvae exposed to cloths treated with 20 candidate mothproofing compounds in standard ASTM tests*<sup>1</sup>

Item No. and ENT No. of candidate compound <sup>2</sup>	Calculated deposit by weight of cloth	Larval mortality			
		Before cleans-ing <sup>3</sup>	After 1 wash-ing	After 1 dry-cleaning	
	Pct.	Pct.	Pct.	Pct.	
Item 2, ENT-25651.....	0.5 0	0	2.5		
	3.0 0	0	7.5		
Item 10, ENT-23438 .....	.5 97.5	0	20		
	3.0 100	0	92.5		
Item 14, ENT-26652-X .....	.5 0	-----	-----		
	3.0 0	-----	-----		
Item 15, ENT-26656.....	.5 0	-----	-----		
	3.0 0	-----	-----		
Item 16, ENT-26655.....	.5 0	-----	-----		
	3.0 0	-----	-----		
Item 30, ENT-23436.....	.5 5	0	0		
	3.0 17.5	0	5		
Item 31, ENT-23969.....	.5 7.5	0	0		
	3.0 42.5	0	0		
Item 38, ENT-23584-X .....	.5 75	0	0		
	3.0 0	0	0		
Item 41, ENT-26261.....	.5 0	-----	-----		
	3.0 0	-----	-----		
Item 55, ENT-16391.....	.5 65	-----	-----		
	3.0 92.5	-----	-----		
Item 58, ENT-23447.....	.5 27.5	0	0		
	3.0 87.5	12.5	0		
Item 72, ENT-24987 .....	.5 0	0	10		
	3.0 0	0	15		
Item 73, ENT-22016.....	.5 0	0	52.5		
	3.0 65	0	97.5		
Item 74, ENT-24988.....	.5 0	0	0		
	3.0 0	0	0		
Item 77, ENT-22751.....	.5 42.5	0	0		
	3.0 22.5	20	0		
Item 78, ENT-23511.....	.5 22.5	0	0		
	3.0 27.5	10	0		
Item 79, ENT-23509.....	.5 97.5	0	0		
	3.0 100	87.5	17.5		
Item 91, ENT-25540.....	.5 72.5	42.5	30		
	3.0 97.5	97.5	60		
Item 128, ENT-26316.....	.5 0	-----	-----		
	3.0 0	-----	-----		
Item 131, ENT-25296.....	.5 0	-----	-----		
	3.0 7.5	-----	-----		

<sup>1</sup> American Society for Testing Materials' 28-day mothproofing test (ASTM D 582-54) provided the test procedure.

<sup>2</sup> The chemical names of the test compounds are listed by item and entomology (ENT) Nos. in the appendix, pp. 5 through 8.

<sup>3</sup> Satisfactorily protected cloths before cleansing in accordance with all ASTM D 582-54 test criteria except one: visible damage was present.



## APPENDIX

## Compounds Evaluated as Potential Mothproofers

Item No.	Entomology No. (ENT-)	Chemical name	Item No.	Entomology No. (ENT-)	Chemical name
1	7705	Acetamide, <i>N</i> -isobutyl-2-phenethoxy-	22	26659	Biguanide, 1,1'-hexamethylenebis[5-[ <i>p</i> -(ethylthio)phenyl]-, compound with 2,2'-thiobis[4,6-dichlorophenol]
2	25651	Acetanilide, 4'-(3,3-dimethyl-1-triazeno)-	23	3357	1-Butanol, 2-amino-
3	19743	Acetic acid, chloro-, ethyl ester	24	31840	2-Butanone, 4-( <i>o</i> -hydroxyphenyl)-, acetate
4	-----	Acetic acid, chloro-, methyl ester	25	32225	2-Butanone, 4-(phenylthio)-
5	19027	Acetic acid, cyano-, ethyl ester	26	3369	Butyramide, 2,2-dichloro-
6	5599	Acetic acid, cyano-, methyl ester	27	18418	Butyramide, <i>N</i> -propyl-
7	-----	Acetic acid, dichloro-, ethyl ester	28	3370	Butyramide, 2,2,3-trichloro-
8	18187	Acetic acid, dichloro-, methyl ester	29	32078	Butyric acid, <i>m</i> -hydroxybenzylidene ester, propionate
9	23283	Acetic acid, [(2-hydroxyethyl) thio]-, ethyl ester, <i>O</i> -ester with <i>O,O</i> -diethyl phosphorothioate	30	23436	Carbamic acid, (mercaptoacetyl)-, ethyl ester, <i>S</i> -ester with <i>O,O</i> -diethyl phosphorodithioate
10	23438	Acetic acid, mercaptophenyl-, ethyl ester, <i>S</i> -ester with <i>O,O</i> -dimethyl phosphorothioate	31	23969	Carbamic acid, methyl-, 1-naphthyl ester
11	4975	Acetonitrile, phenyl-	32	24717	Crotonic acid, 3-hydroxy-, $\alpha$ -methylbenzyl ester, dimethyl phosphate
12	41005	<i>Acorus calamus</i> root, pentane extractive	33	24654	Crotonic acid, 3-hydroxy-, benzyl ester, dimethyl phosphate
13	-----	Acrylonitrile, 3-ethoxy-	34	24990	Crotonic acid, 3-hydroxy-, 2,4-dichlorobenzyl ester, dimethyl phosphate
14	26652-X	Ammonium, alkylbenzyl-dimethyl-, compound with 2,2'-thiobis[4,6-dichlorophenol]	35	17510	Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-methylpropenyl)-, ester with 2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one
15	26656	Ammonium, diethyl(2-hydroxyethyl) methyl—bromide, benzilate	36	16225	1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro- <i>endo-exo</i> -
16	26655	Ammonium, triethyl(2-hydroxyethyl)—bromide, benzilate	37	31967	<i>m</i> -Dioxane, 5-butyl-5-ethyl-2-nonyl-
17	8906	Benzaldehyde, <i>m</i> -nitro-	38	23584-X	Disulfide, bis(dialkyloxyphosphinothioyl), a mixture
18	16538	Benzenesulfonic acid, <i>p</i> -chloro-, <i>p</i> -chlorophenyl ester			
19	9624	Benzhydrol, 4,4'-dichloro- $\alpha$ -methyl-			
20	7823	Benzoic acid, allyl ester			
21	26209	1,2,3-Benzotriazin-4(3 <i>H</i> )-one, 3-butyl-			

<i>Item No.</i>	<i>Entomology No. (ENT-)</i>	<i>Chemical name</i>	<i>Item No.</i>	<i>Entomology No. (ENT-)</i>	<i>Chemical name</i>
39	17082	Ethane, 1,1-dichloro-2,2-bis ( <i>p</i> -ethylphenyl) -	59	23842	Orthoformic acid, trimethyl ester
40	1506	Ethane, 1,1,1-trichloro-2,2-bis ( <i>p</i> -chlorophenyl) -	60	25031	Peroxycarbamic acid, dimethyltrithio-, <i>tert</i> -butyl ester
41	26261	Glutarimide, 3-[2-(3,5-dimethyl-2-oxocyclohexyl)-2-hydroxyethyl]-, methylhydrazone	61	157	Phenol, 2-cyclohexyl-4,6-dinitro-
42	23445	Glycolic acid, ethyl ester, <i>O</i> -ester with <i>O,O</i> -diethyl phosphorothioate	62	19106	Phenol, 2,4-dichloro-, benzenesulfonate
43	1540	Indole	63	704	Phenoquinone
44	50031	Ketone, methyl 3-pyridyl	64	38	Phenothiazine
45	18891	Malonaldehyde, bis (diethyl acetal)	65	25410	Phosphonic acid, (chloromethyl) -
46	.....	Malonaldehyde, bis (dimethyl acetal)	66	22268	Phosphonium, tetrakis (hydroxymethyl) —chloride
47	.....	Malonaldehyde, ethyl trimethyl diacetal	67	25713	Phosphonodithioic acid, ethyl-, <i>O</i> -ethyl <i>S-p</i> -tolyl ester
48	24285	Malononitrile	68	25755	Phosphonothioic acid, ethyl-, <i>O</i> -(2-chloro-4-nitrophenyl) <i>O</i> -isopropyl ester
49	.....	Malononitrile, (ethoxymethylene) -	69	25712	Phosphonothioic acid, ethyl-, <i>O</i> -ethyl <i>O</i> -2,4,5-trichlorophenyl ester
50	25700-X	6,9-Methano-3 <i>H</i> -2,4-benzodioxepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-3-methyl- (chlorinated to contain 70% total chlorine content)	70	24911	Phosphoramidic acid, methyl-, diethyl ester
51	25603	4,7-Methanoidan, 1,2,4,5,6,7,8,8-octachloro-2,3-epoxy-3a,4,7,7a-tetrahydro-	71	23285	Phosphoramidothioic acid, <i>O</i> -methyl <i>O</i> -2,4,5-trichlorophenyl ester
52	25584	4,7-Methanoindan, 1,4,5,6,7,8,8-heptachloro-2,3-epoxy-3a,4,7,7a-tetrahydro-	72	24987	Phosphorazidothioic acid, <i>O,O</i> -diethyl ester
53	9932	4,7-Methanoindene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-	73	22016	Phosphoric acid, 2-chloroethyl 2,2-dichlorovinyl ethyl ester
54	23872	Methanol, phosphinylidynetri-	74	24988	Phosphoric acid, 1,2-dibromo-2,2-dichloroethyl dimethyl ester
55	16391	1,3-4-Metheno-2 <i>H</i> -cyclobuta [cd]pentalen-2-one, decachlorooctahydro-	75	20738	Phosphoric acid, 2,2-dichloro-vinyl dimethyl ester
56	1185	5-Norbornene-2,3-dicarboxi-mide, <i>N</i> -butyl-	76	25631	Phosphoric acid, 2,2-dichloro-vinyl methyl phenyl ester
57	1000	5-Norbornene-2,3-dicarboxi-mide, <i>N</i> -pentyl-	77	22751	Phosphorodithioic acid, <i>S-p</i> -chlorobenzyl <i>O,O</i> -diethyl ester
58	23447	2-Norbornene, 1,2,3,4,7,7-hexachloro-5- (dichloromethyl) -	78	23511	Phosphorodithioic acid, <i>S-p</i> -chlorobenzyl <i>O,O</i> -diisopropyl ester

<i>Item No.</i>	<i>Entomology No. (ENT-)</i>	<i>Chemical name</i>	<i>Item No.</i>	<i>Entomology No. (ENT-)</i>	<i>Chemical name</i>
79	23509	Phosphorodithioic acid, <i>S-p</i> -chlorobenzyl <i>O,O</i> -dimethyl ester	94	6470	Phthalimide, <i>N</i> -allyl-
80	23510	Phosphorodithioic acid, <i>S-p</i> -chlorobenzyl <i>O,O</i> -dipropyl ester	95	1395 (-6465)	Phthalimide, <i>N</i> -propyl-
81	23446	Phosphorodithioic acid, <i>O,O</i> -diethyl ester, <i>S</i> -ester with mercaptophenylacetoneitrile	96	24110	3-Picoline
82	23437	Phosphorodithioic acid, <i>O,O</i> -diethyl <i>S</i> -[2-(ethylthio)ethyl]ester	97	24111	4-Picoline
83	25506	Phosphorodithioic acid, <i>O,O</i> -dimethyl ester, <i>S</i> -ester with <i>N</i> -ethyl-2-mercaptoacetamide	98	17950	2-Picoline, 6-acetamido-
84	24650	Phosphorodithioic acid, <i>O,O</i> -dimethyl ester, <i>S</i> -ester with 2-mercapto- <i>N</i> -methylacetamide	99	17951	3-Picoline, 2-acetamido-
85	25737	Phosphorodithioic acid, <i>S</i> -4,6-dimethyl-2-pyrimidinyl <i>O,O</i> -diethyl ester	100	17952	4-Picoline, 2-acetamido-
86	22734	Phosphorothioic acid, <i>O</i> -[2- <i>sec</i> -butoxymethyl)thio]-ethyl] <i>O,O</i> -diethyl ester	101	19242	Picolinic acid
87	17035	Phosphorothioic acid, <i>O</i> -(2-chloro-4-nitrophenyl) <i>O,O</i> -dimethyl ester	102	17308	Piperidine, 1,1'-carbonyldi-
88	23440	Phosphorothioic acid, <i>O</i> -[2-(diethylamino)ethyl] <i>O,O</i> -diethyl ester	103	30642	Propionanilide, 2-methyl-2'-nitro-
89	19507	Phosphorothioic acid, <i>O,O</i> -diethyl <i>O</i> -(2-isopropyl-4-methyl-6-pyrimidinyl) ester	104	25273	Propionic acid, 2,3-dichloro-2-methyl-, sodium salt
90	23439	Phosphorothioic acid, <i>O,O</i> -diethyl <i>O</i> -[2-(2-pyridyl)-ethyl]ester	105	26060	Pseudourea, 2-(1-naphthylmethyl)-2-thio-, hydrochloride
91	25540	Phosphorothioic acid, <i>O,O</i> -dimethyl <i>O</i> -[(4-methylthio)- <i>m</i> -tolyl]ester	106	15287	Pyridine, 2-amino-
92	23284 (-24726)	Phosphorothioic acid, <i>O,O</i> -dimethyl <i>O</i> -2,4,5-trichlorophenyl ester	107	17853	Pyridine, 3-bromo-
93	15624	Phosphorus acid, triethyl ester	108	1104	Pyridine, ( <i>p</i> -nitrophenyl)-
			109	8869	Quinoline, 6-methyl-
			110	8114	Salicylanilide
			111	26548	Sodium, [2,4-dichloro-6-[(3,5-dichloro-2-hydroxyphenyl)-thio[phenoxy]-
			112	26653	Sodium, [thiobis[(4,6-dichloro- <i>O</i> -phenylene)-oxy]]di-
			113	16827	Styrene, <i>beta</i> -nitro-
			114	17034	Succinic acid, mercapto-, diethyl ester, <i>S</i> -ester with <i>O,O</i> -dimethyl phosphorodithioate
			115	32329	Succinic acid, methylene-, bis-(2-bromoethyl) ester
			116	952	Sulfanilamide
			117	1048	Sulfanilamide, <i>N</i> <sup>1</sup> -amidino-
			118	1050	Sulfanilamide, <i>N</i> <sup>1</sup> -2-thiazolyl-
			119	20696	Sulfide, <i>p</i> -chlorobenzyl <i>p</i> -chlorophenyl
			120	23737	Sulfone, <i>p</i> -chlorophenyl 2,4,5-trichlorophenyl
			121	19442-X	Terpene polychlorinates (65% chlorine) (Strobane)
			122	14917	Thiazole, 2-amino-
			123	986	2-Thiazoline-2-thiol

<i>Item No.</i>	<i>Entomology No. (ENT-)</i>	<i>Chemical name</i>	<i>Item No.</i>	<i>Entomology No. (ENT-)</i>	<i>Chemical name</i>
124	6	Thiocyanic acid, 2-(2-butoxyethoxy) ethyl ester	129	50108	s-Triazine, 4,6-diamino-1-[3-chloro-4-(ethylthio)-phenyl]-1,2-dihydro-2,2-dimethyl-, hydrochloride
125	26188	<i>m</i> -Toluidine, <i>alpha, alpha</i> , <i>alpha</i> -trifluoro-4-nitro-	130	24915	Tris (1-aziridiny) phosphine oxide
126	26186	<i>p</i> -Toluidine, <i>alpha, alpha</i> , <i>alpha</i> -trifluoro-2-nitro-	131	25296	2,4,6-Tris (1-aziridiny) -s-triazine
127	24917	1,3,5,2,4,6-Triazatriphosphorine, 2,2,4,4,6,6-hexachloride	132	7549	Urea, 1-phenyl-2-thio-
128	26316	1,3,5,2,4,6-Triazatriphosphorine, 2,4,6-hexakis (1-aziridiny) -2,2,4,4,6,6-hexahydro-	133	3582	Urea, thio-
			134	23443	Xanthic acid, ethyl-, (ethylthio) methyl ester

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<i>ENT No.</i>	<i>Commercial or common name</i>	<i>Item No.</i>	<i>ENT No.</i>	<i>Commercial or common name</i>	<i>Item No.</i>
6	Lethane 384	124	9932	Chlordane	53
38		64	14917		122
157		61	15287		106
704		63	15624		93
952		116	16225	Dieldrin	36
986		123	16391	Kepone	55
1000		57	16538	Ovex	18
1048		117	16827		113
1050		118	17034	Malathion	114
1104		108	17035	Dicapthon	87
1185		56	17082	Perthane	39
1395 (=6465)		95	17308		102
1506	DDT	40	17510	Allethrin	35
1540	Indole	43	17853		107
3357		23	17950		98
3369		26	17951		99
3370		28	17952		100
3582		133	18187		8
4975		11	18418		27
5599		6	18891		45
6465	See 1395	95	19027		5
6470		94	19106		62
7549		132	19242		101
7705		1	19442-X	Strobane	121
7823		20	19507	Diazinon	89
8114	Salicylanilide	110	19743		3
8869		109	20696	Chlorbenside	119
8906		17	20738	Dichlorvos	75
9624		19	22016	Bay 16574	73



<i>ENT No.</i>	<i>Commercial or common name</i>	<i>Item No.</i>	<i>ENT No.</i>	<i>Commercial or common name</i>	<i>Item No.</i>
22268		66	25273		104
22734	Bay 16948	86	25296	Tretamine	131
22751	Bay 18341	77	25410		65
23283	Bay 16900	9	25506	American Cyanamid 18706	83
23284 (= 24726)	Ronnel	92	25540	Fenthion	91
23285	Dow ET-15	71	25584	Velsicol 53-CS-17	
23436	Bay 19596	30		(heptachlor epoxide)	52
23437	Di-Syston	82	25603	Velsicol 57-CS-47	51
23438	Bay 18510	10	25631	Shell SD 6056	76
23439	Bay 19994	90	25651	American Cyanamid 24055	2
23440	Bay 18935	88	25700-X	Bay 38920	50
23443	Bay 20743	134	25712	Bay 37289	69
23445	Bay 18613	42	25713	Bay 38156	67
23446	Bay 19641	81	25737	Stauffer R-3413	85
23447	Hercules AC 426A	58	25755	Stauffer N-2404	68
23509	Bay 18780	79	26060		105
23510	Bay 18781	80	26186		126
23511	Bay 18786	78	26188		125
23584-X	Phostex	38	26209	Maumee 3787	21
23737	Tedion	120	26261		41
23842		59	26316	Apholate	128
23872		54	26548		111
23969	Carbaryl	31	26652-X	Win 4257-14	14
24110		96	26653	Win 4257-17	112
24111		97	26655	Win 4723	16
24285		48	26656	Win 4724	15
24650	Dimethoate	84	26659	Win 14726-6	22
24654	Shell SD 4092	33	30642		103
24717	Ciodrin	32	31840		24
24726	See 23284	92	31967		37
24911		70	32078		29
24915	Tepa	130	32225		25
24917		127	32329		115
24987	Bay 13242	72	41005	<i>Acorus calamus</i> root,	
24988	Naled	74		pentane extractive	12
24990	Shell SD 4457	34	50031		44
25031		60	50108	WIN 18006	129

### Index to Compounds Without Entomology (ENT) Numbers

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Acetic acid, chloro-, methyl ester	4	Malonaldehyde, bis(dimethyl acetal)	46
Acetic acid, dichloro-, ethyl ester	7	Malonaldehyde, ethyl trimethyl diacetal	47
Acrylonitrile, 3-ethoxy-	13	Malononitrile, (ethoxymethylene)-	49



